Induced Seismicity by Injection Associated With Oil & Gas Development:

A Primer on Technical & Regulatory Considerations Informing

Risk Management and Mitigation

This report is developed by the ISIWG members, with input and support from the ISIWG technical advisors, to help better inform all stakeholders and the broad public on technical and regulatory considerations associated with traffic light systems, monitoring systems, information sharing, and the use of ground shaking metric.

It is also intended to summarize the range of approaches that have been used, or are currently being used, in many local regions to manage and mitigate the risks associated with seismicity that may be induced by injection.

This is an informational document, and is not intended to offer recommended rules or regulations. The ISIWG recognizes that management and mitigation of induced seismicity is best considered at the local / regional levels due to the significant variability in local geology and surface conditions (e.g., population density, building conditions, infrastructure, critical facilities, monitoring capabilities, etc.)

1.0 Preface

State oil and gas regulatory agencies and geological surveys have partnered with the Interstate Oil & Gas Compact Commission and Ground Water Protection Council to create a work group that will proactively discuss the possible association between recent seismic events occurring in multiple states and injection wells. State agencies participating in the Induced Seismicity by Injection Work Group collaborate and share science, research, and practical experience to equip the states with the best decision making tools to evaluate the possible connections between seismic events and injection wells, minimize risk, and enhance appropriate readiness when seismic events occur.

2.0 Executive Summary

This section would be 1-2 pages providing concise summary of the major observations and considerations associated with the report.

3.0 Purpose and Scope

This section would be short and describe the specific purpose of the present document and the applicable scope of the present document.

4.0 Background & Issue Overview

This section would summarize key papers and knowledge base on the topic, leveraging the National Academy of Sciences (2012) report, Department of Energy Geothermal Report, USGS reports, and several of the significant events associated with injection induced seismicity.

6.0 Information Sharing to Address Risks and Hazards

6.1 Overview

A. Understanding Issues of Data Availability (Regulatory, Industry, Stakeholder Perspectives)

B. Understanding the Issues of Data Compartmentalization (Regulatory, Industry, Stakeholder Perspectives)

C. Understanding Current Challenges with Subsurface Fault Mapping

D. Understanding What May Be Considered "Readily Available" Data

E. Understanding Information Fragmentation

F. Understanding Information Management Systems & Constraints

G. Understanding the Nature of Proprietary and Confidential Business Information

6.2 Informing a Risk Assessment

A. Historical Seismicity Data (hypocenter, event sequence / timing)

B. Surface Site Characterization

C. Subsurface Site Characterization

D. Injection Well Information

6.3 Informing a Risk Mitigation Plan

A. Options Based on Local Risk Level

B. Options Based on Local Monitoring Resources

6.4 Informing a Causality Evaluation

A. 4-D investigation of all of the available data

B. Identification and characterization of reactivated faults

C. Hypocenters: accuracy of locations, and temporal evolution

D. Applications of Gutenberg-Richter relationships

E. Use of reservoir modeling approaches to evaluate subsurface pressure

F. Integration of all available data